Using CrIS Ammonia Observations To Improve Decision Making on $PM_{2.5}$ Control Policies

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NH_3 sources are not well known

Biomass burning

Automobiles (catalytic converters)
- Large urban centers
    - 50% of NH_3 in LA area (Nowak et al., GRL, 2012)

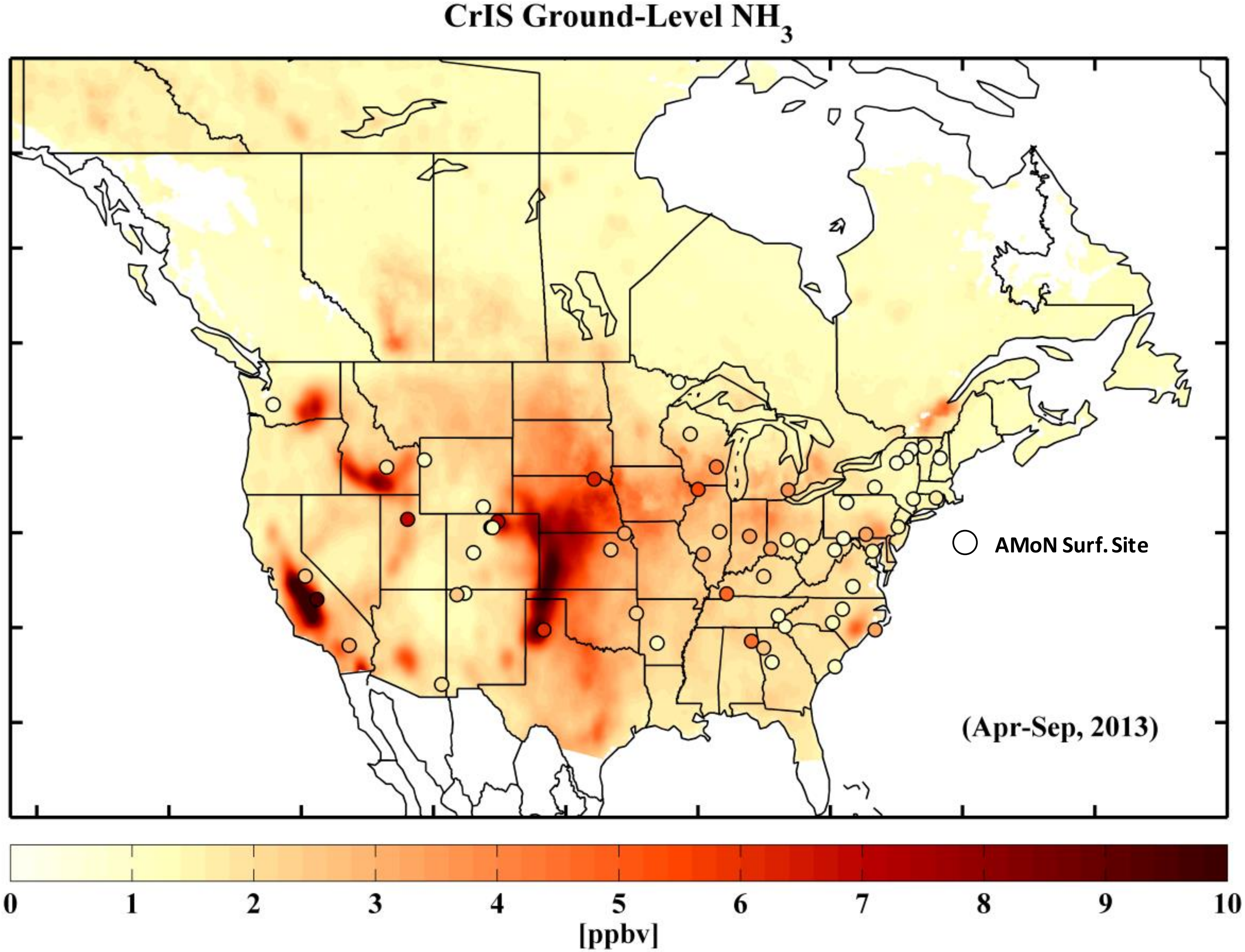
Industry
- Fertilizer
- Coal Mining
- Power generation

Bi-directional Flux

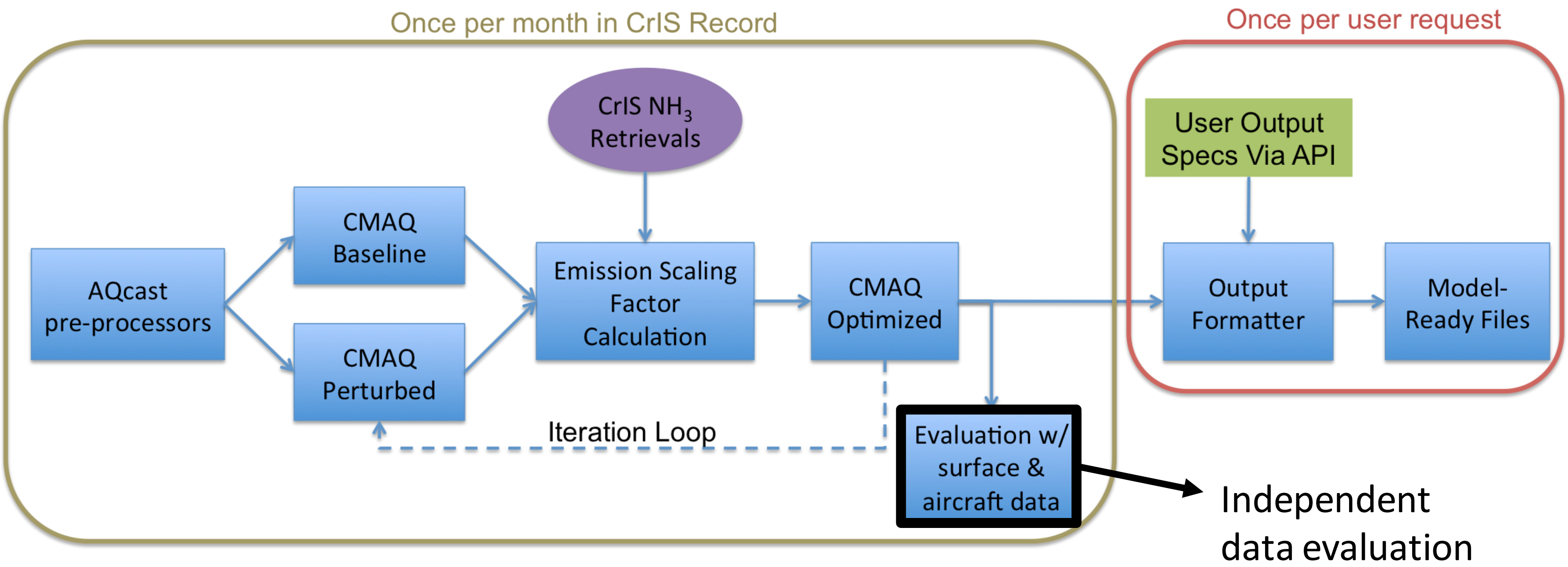
AGRICULTURE
- Animal waste (temperature dependent)
- Fertilizer application

CrIS can identify NH_3 sources

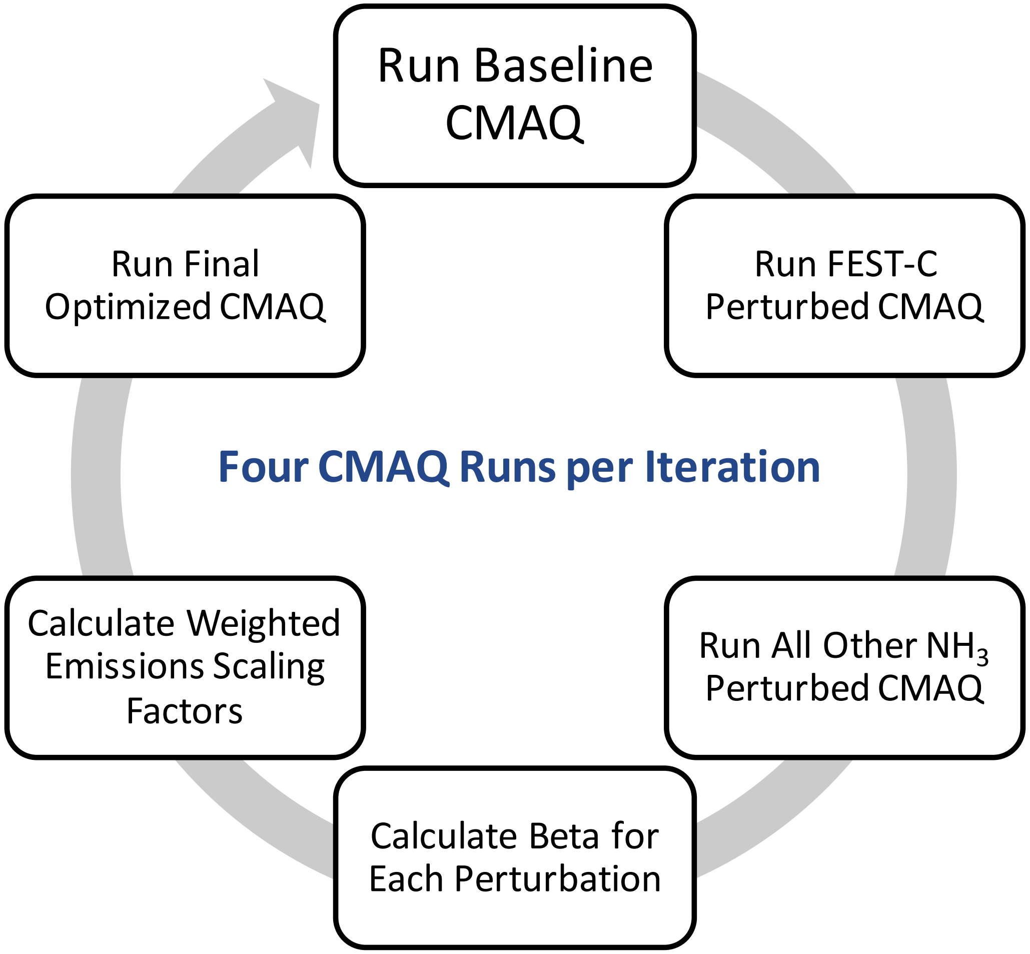
- CrIS Satellite NH_3 warm season (Apr. – Sept., 2013) average surface map, with corresponding AMoN surface network measurements overlaid.



Schematic Overview of Project Workflow



Latest Updates: Calculation of Final NH_3 Emissions using bidirectional flux



Update: Final Weighted Emissions Scaling Factors for Bidirectional Input and All Other NH_3 Emissions

Applied to Bidirectional Flux Input

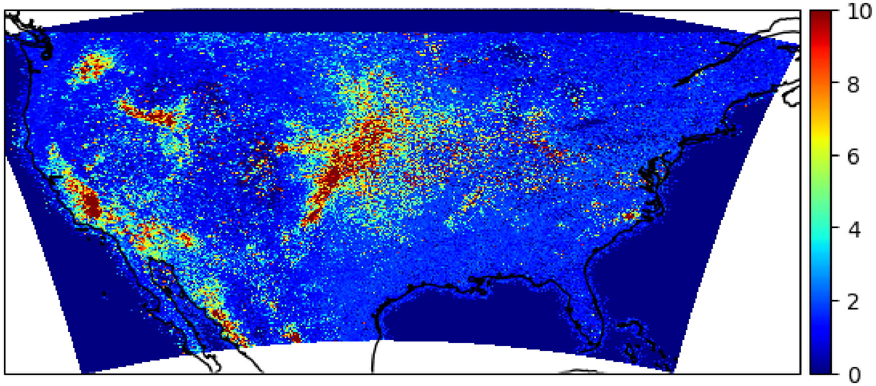
$$E_{t_{bidi}} = E_{a_{bidi}} \underbrace{\left(1 + \frac{\Omega_o - \Omega_a}{\Omega_a}\left(\frac{NH_{3_{FESTC}}}{NH3_{TOTAL}}\right)\beta_{festc}\right)}_{\text{Limit: } 0-5}$$

Applied to All Other NH_3 Input

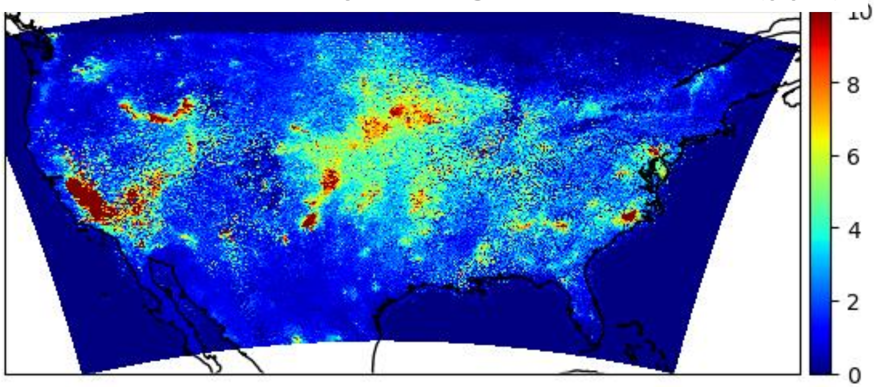
$$E_{t_{other}} = E_{a_{other}} \underbrace{\left(1 + \frac{\Omega_o - \Omega_a}{\Omega_a}\left(\frac{NH_{3_{OTHER}}}{NH3_{TOTAL}}\right)\beta_{other}\right)}_{\text{Limit: } 0-5}$$

Pre-inversion NH_3 (June 2015, 12US2)

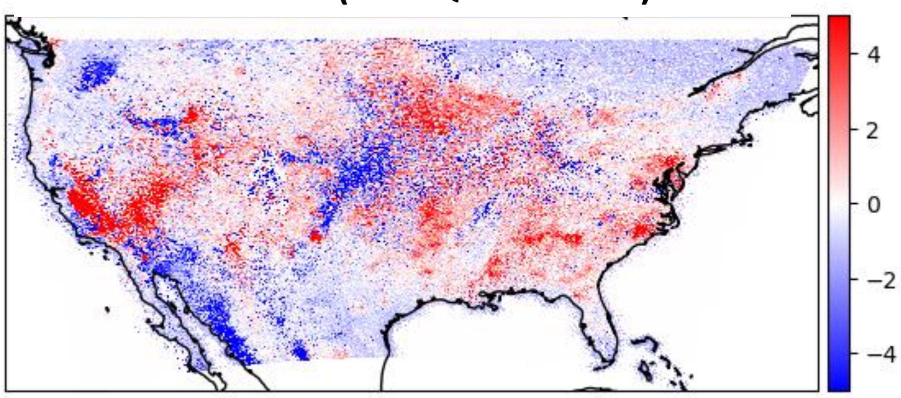
CrIS Monthly-Averaged Surface Conc (ppb)



CMAQ Base Monthly-Averaged Surface Conc (ppb)

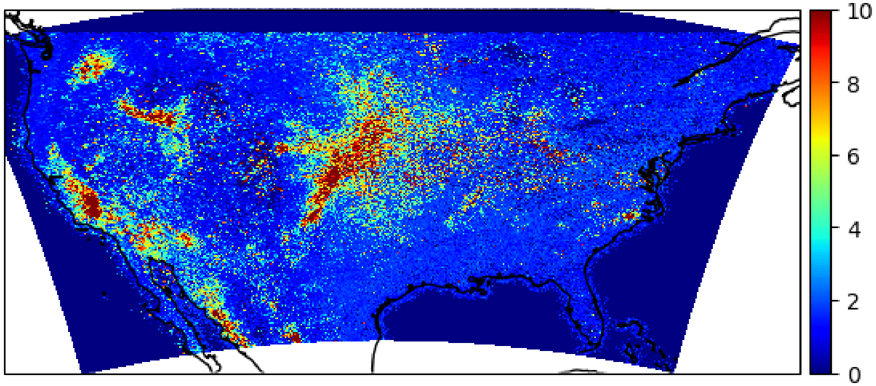


Difference (CMAQ minus CrIS)

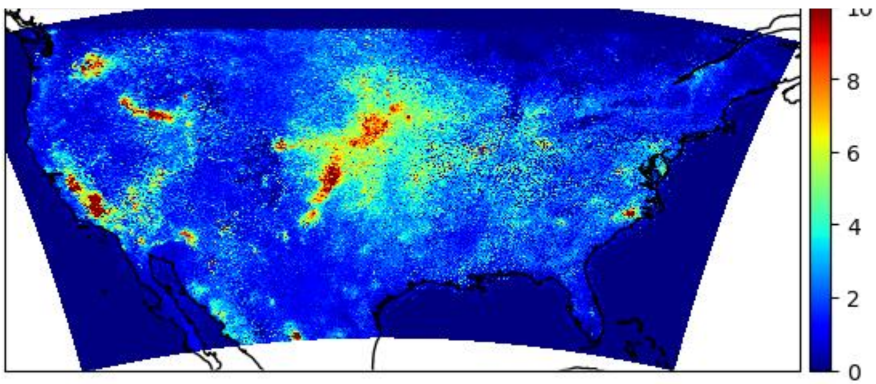


Post-inversion NH_3 (June 2015, 12US2)

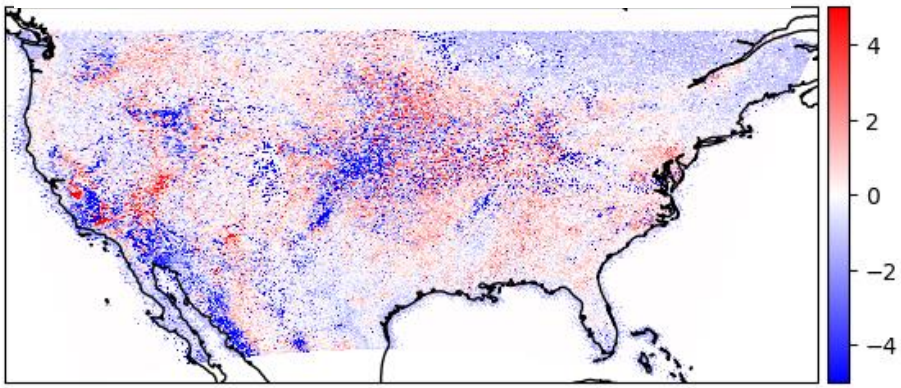
CrIS Monthly-Averaged Surface Conc (ppb)



CMAQ Sfc-Inv Monthly-Averaged Surface Conc (ppb)

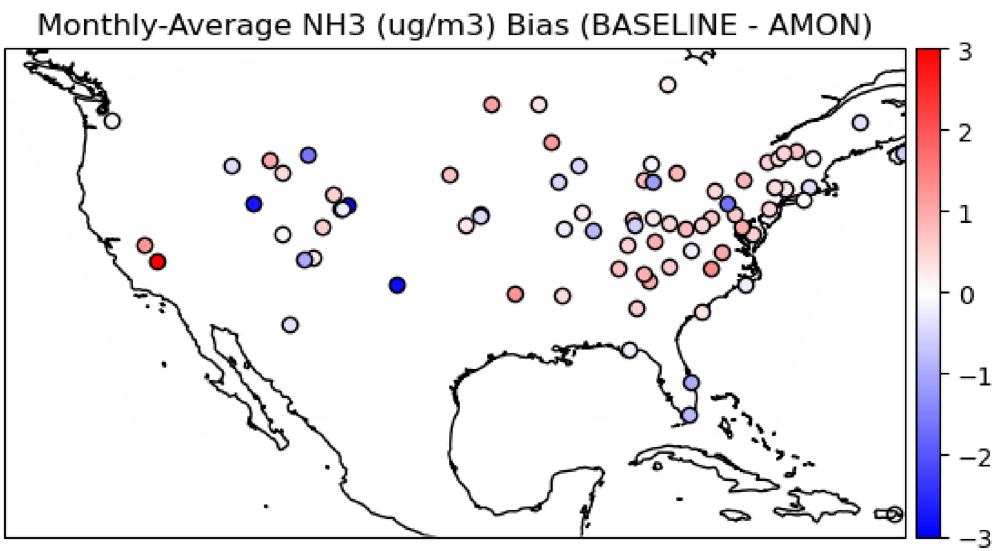


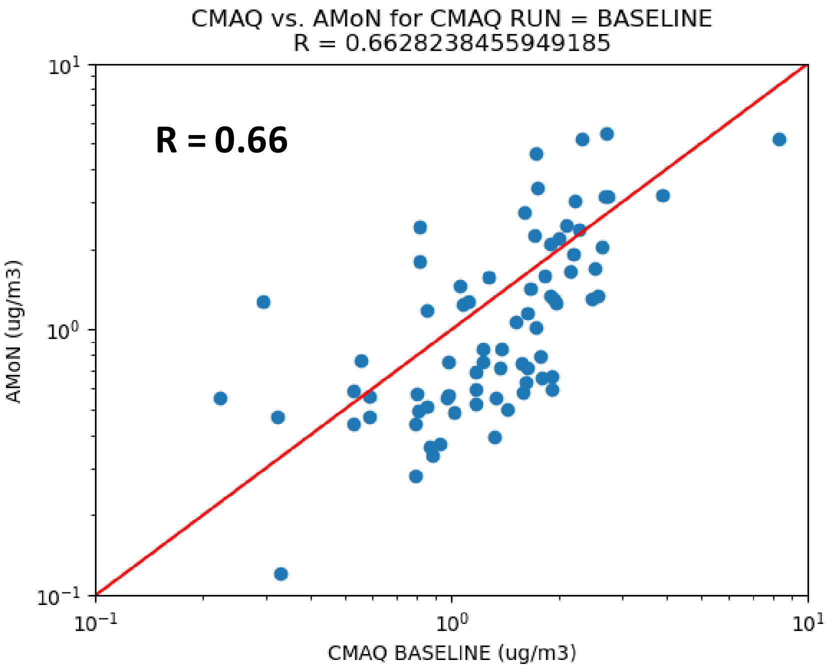
Difference (CMAQ minus CrIS)



12 km Run Comparison with AMoN

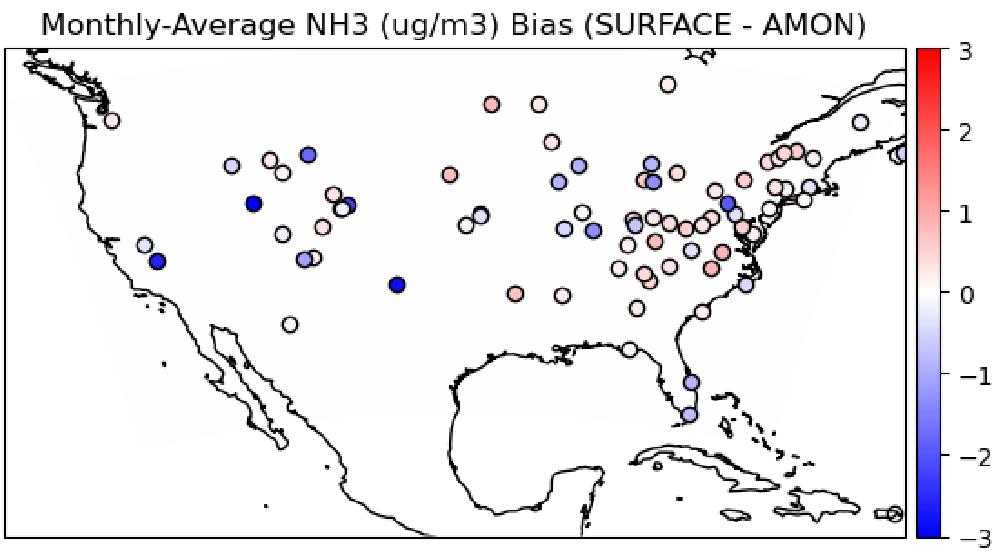
CMAQ BASE Comparison with AMoN

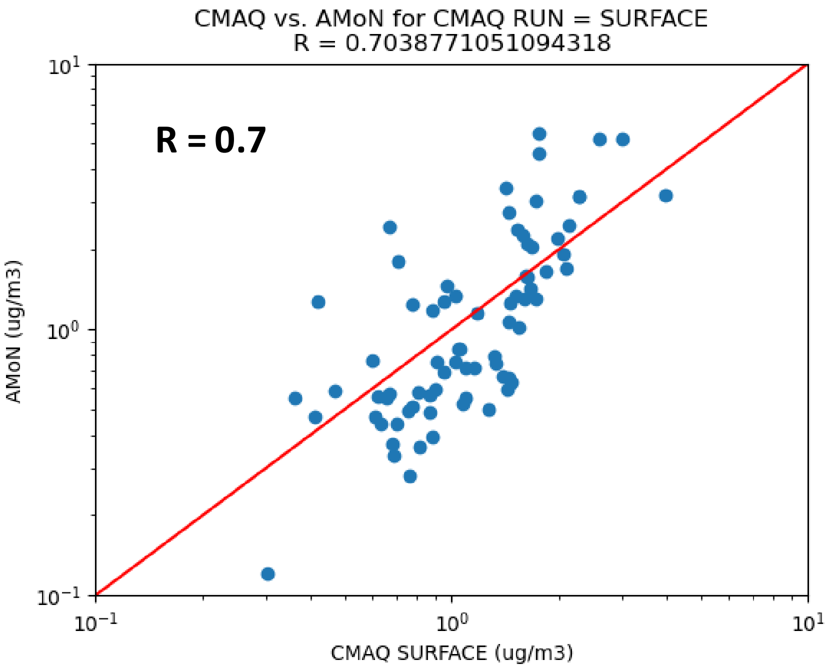




12 km Run Comparison with AMoN

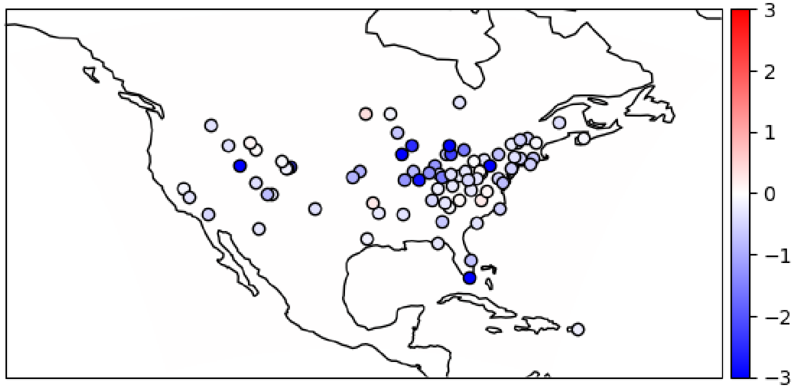
CMAQ Iteration 1 – Surface Inversion Comparison with AMoN



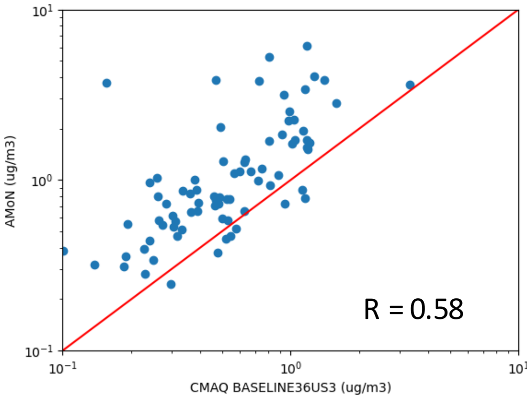


36 km Run Comparison with AMoN

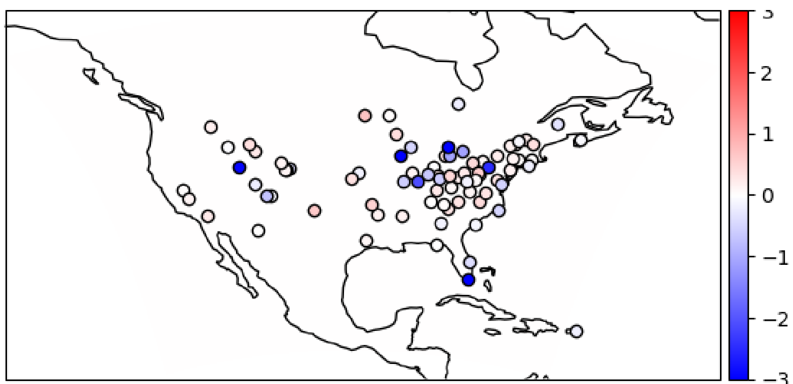
Baseline minus AMoN



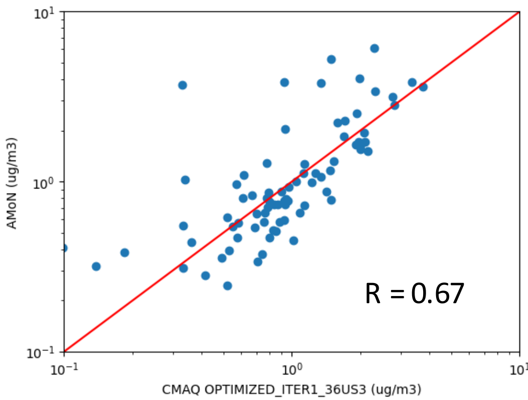
Baseline



Post-Inversion minus AMoN



Post-Inversion



Current Work

- Working with ECCC to get better prior NH_3 emissions over Canada
- Working with EPA to get 12US1 simulations for April 2018
- Finalizing all code for distribution runs

Project ARL

- Start-of-Project ARL = 3 *(11-16-2018)*
- Goal ARL = 7
- Current ARL = 5 *(8-16-2021)*

Summary

- This work will provide improved NH_3 emission inventories to air quality forecasters, managers, and other stakeholders.

- Application of the inversion using bidirectional NH_3 flux for the first time for June 2015 proved successful. The process improved comparisons with CrIS and an independent dataset, AMoN.

- Our ongoing work will make the approach applicable at 36 km across NA and provide EPA with emissions files for testing in their existing decision-making activities.